

Interactive comment on “Role of aldehyde chemistry and NO_x concentrations in secondary organic aerosol formation” by A. W. H. Chan et al.

Anonymous Referee #2

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General Comments

This manuscript presents results of laboratory studies of the gas and particle phase products of the reactions of a series of unsaturated aldehydes and a couple of alcohols with OH radicals in the presence of different NO₂/NO ratios. The focus is on the effect of this ratio on secondary organic aerosol (SOA) formation and also on identifying the major reaction products and the mechanisms by which they are formed. The experiments are very well done, the compounds that were chosen for the study are ideal for teasing out the details of the reaction mechanism and importance of NO₂, and the combined gas-phase CIMS, and AMS and off-line mass spectrometry for SOA analysis combine to produce a fairly complete picture of the chemistry. The results obtained here and in previous studies by this group provide convincing evidence that

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a major component of the SOA is oligomeric esters formed from the reactions of multifunctional carboxylic acids containing hydroxy and nitrooxy groups and that the precursors to these monomers are PAN-type products whose formation is promoted at high NO₂/NO ratios. The mechanism by which PAN-type products lead to oligomers still needs to be worked out, but this can wait for future studies. The potential importance of NO₂ in forming SOA has not been previously appreciated, and the study represents a significant advance in understanding the atmospheric chemistry of unsaturated aldehydes and therefore one of their major sources, isoprene. I highly recommend the paper be published in ACP after these minor comments are addressed.

Specific Comments

1. Page 10240, lines 20–25: Do you mean specifically alpha-beta unsaturated aldehydes may be important in SOA formation or all aldehydes?
2. Page 10237, lines 11–15 and Page 10263, Figure 10: It looks like the stoichiometry of the reactions for forming the dihydroxyacid and hydroxynitrooxyacid by reaction of the dioxetone intermediate with H₂O and HNO₃ is incorrect. To form these products the dioxetone would need to react with H₂ and HNO₂, or if the reactions occurred with H₂O and HNO₃ then O atoms would have to be formed as products. This probably makes the proposed reactions less likely.

Technical Corrections

1. Page 10252, Table 1: I think the MBO232 and MBO231 structures in the table are reversed.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 10219, 2010.

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